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THE CERCARIAE OF NATAL

F. G. CAWSTON

During the months of April, May, June, and July of 1916, I examined 1,500 molluscs from the rivers and fresh-water pools of Natal. They included several species. *Limnaea natalensis* is a common form with a dextral shell. *Physopsis africana*, a common mollusc amongst decomposing vegetation, has a blunt-pointed sinistral shell with a truncate columella. *Planorbis pfeifferi* is a common form with a round, flat shell. *Planorbis leucocheilus* is not unlike it, but is much smaller. *Isidora tropica* is fairly common; it has a blunt-pointed sinistral shell. *Isidora forskali* is rarer and has a conical shell. In one brickfield I found a large number of specimens of *Ancylus (ferrissia) burnupi*, which has a small oval shell.

Two hundred eleven specimens harbored cercariae of various kinds. Infected specimens were most common in one brickfield at Durban and in a small pool along the course of the Umsindusi River at Pietermaritzburg, which had been formed as a result of an overflow of the river. Infected specimens were most frequently met with in May and June. All of the cercariae possessed a long, slender tail; those that were found in specimens of *Physopsis africana* more often than not possessed divided tails. The tail was easily detached from the body of a cercaria and continued to move for some time after becoming free. All of the cercariae were distomes; the oral sucker was terminal, and in a few specimens the posterior border of the sucker was incomplete; the acetabulum was situated slightly nearer the tail end of the body. None of the cercariae had spines or stylets, and there were no projections from the body or tail. A pharynx was noted in only one form, and eye-spots were present only in cercariae from one specimen.

CERCARIA CATENATA

A large cercaria, *Cercaria catenata*, from the Toll Gate brickfield at Durban, present in about 30 per cent of *Planorbis pfeifferi* and in fewer *Limnaea natalensis* and *Physopsis africana* developed in rediae. These rediae gave an orange color to the liver-substance of infected specimens. The rediae were very mobile and possessed two pairs of locomotor appendages. The posterior extremity was pointed. There were infoldings of outer cuticula at the extremities of the posterior extremity of the redia and of its appendages which were not unlike suckers. The rediae contained a somewhat distended intestine,

a large amount of orange pigment, and several fully developed cercariae. On one occasion a cercaria was seen attempting to draw itself through the ruptured wall of the redia by means of its suckers. The head of the cercaria varied in appearance, but was often shaped like a leaf. It possessed a large oral sucker and a large acetabulum or ventral sucker; a chain of blackish granules, varying in number from about twenty-five to twenty-eight, lay on each side of the divided alimentary canal. The tail of the cercaria was as long or slightly longer than the body and tapered towards its extremity. Hypodermic injection of a large number of both rediae and cercariae into a guinea-pig threw no light whatever on the life history of this cercaria, which was the only form found to develop in rediae.

"TADPOLE" CERCARIAE

Sixteen sporocysts, containing leptocercous distomes, or "tadpole" cercariae, were found in *Physopsis africana* from the Umsindusi. Similar sporocysts were present in two specimens of *Limnaea natalensis* from the same source. The sporocyst intersected almost the entire liver-substance of infected specimens, giving it a whitish appearance. The cercariae consisted of a body with two suckers and a tail which was about the same length as the body. There was a divided gut and an elementary bladder. Some forms presented a stumpy appearance, others were longer. Some of these cercariae found in Durban suggested the appearance of Schistosoma cercariae in every respect except that their tail was not divided.

No cercariae were found in specimens of *Isidora* (over fifty were examined from infected places), and furcocercous cercariae were found only in specimens of *Physopsis africana*. Some specimens of this latter mollusc harbored more than one form of cercaria. Occasionally one came across a specimen which harbored both the "tadpole" and furcocercous forms.

Ninety-nine specimens of *Physopsis africana* harbored Bilharzia cercariae. These are characterized by the absence of a pharynx and by a divided tail. One specimen obtained from the Durban brickfields on May 9 harbored cercariae with long undivided tails, as well as a sporocyst containing an eye-spotted form of furcocercous cercaria. This is the only specimen of the kind I have seen, and, in consideration of its resemblance to the Egyptian form, I have suggested for it the name *Cercaria oculata*. The eye-spots had a crescentic appearance and were situated nearer the oral end of the body, on either side of the divided gut. They could be readily seen through the thin walls of the sporocyst in which the cercariae were well developed. No pharynx was discernible in the body of the cercariae. There was a long, slender tail which was divided into two short, fin-like prongs.

CERCARIA SECOBIANA

A common cercaria from the Umsindusi pool, for which I have suggested the name *Cercaria secobiana*, occurred in about seventy specimens of *Physopsis africana*. It was narrower and slightly smaller than the eye-spotted form. This distome had a long, slender tail which was divided into two prongs. The prongs were as long as the tail itself. When the tail moved, the prongs became bent to the form of a crescent, causing the cercaria to swim backwards — a form of locomotion which would seem to be common to furcocercous cercariae. The cercariae developed in a sporocyst which intersected the whole liver-substance of an infected specimen. They were found only in *Physopsis africana* from the Umsindusi River. At present, no light has been thrown upon the life-history of this cercaria, which has the appearance of an avian trematode.

SCHISTOSOME CERCARIAE

Cercariae which answered to the description of the Schistosome group were found in sporocysts from the liver-substance of twenty-three specimens of *Physopsis africana* (15 per cent) from the brick-fields at Durban. They were present in a lesser proportion of specimens of this same mollusc collected from the Umsindusi River. Bilharzia disease is common amongst bathers in both these places. Except for the absence of eye-spots, the cercariae were identical with the eye-spotted form. The long, slender tail was divided into two short, fin-like prongs. There was no pharynx to be seen. In the *Medical Journal of South Africa* for April, 1916, Dr. J. G. Becker reported that these distome cercariae occurred in *Physopsis africana* from a pool at Nijstroom in the Transvaal. I have seen the microscopic preparations he has made of them. He injected some hypodermically into a guinea-pig and, as I announced at a meeting of the Witwatersrand Branch of the British Medical Association two months later, succeeded in producing three adult male Bilharzia worms in the portal system. This confirmed the opinion that these cercariae, which have only been found in areas known to be infected with Bilharzia disease, are in reality the larval form of the Bilharzia parasite of man.

On April 28, I added some water containing miracidia obtained from the urine of a patient suffering from Bilharziasis to a vessel of water containing specimens of *Physopsis africana* from the Umsindusi River. At the end of a fortnight a small sporocyst containing undefined cercariae was seen throwing out branches throughout the liver-substance of one specimen, giving it a yellowish-white appearance. In another specimen a similar young sporocyst occurred; in this could be seen undeveloped cercariae with bifid tails. By the end of three weeks

fourteen out of thirty-one specimens, or 45 per cent, harbored *Bilharzia cercariae*, while only 15 per cent of specimens obtained direct from the river were found to be infected at that period of the year. In another series of experiments, the addition of miracidia to the water in which specimens of *Physopsis africana* were kept, apparently increased the number of infected forms from 22 to 37 per cent, and from 23 to 27 per cent. Similar experiments with specimens of *Planorbis pfeifferi* and *Limnaea natalensis* proved entirely negative.

SNAILS HARBORING "TADPOLE" CERCARIAE, 1916

Date	Source	Species	No. Infected	Percentage
April.....	Umsindusi.....	<i>Limnaea natalensis</i>	2 out of 88	1.6
May.....	(Pietermaritzburg)...	<i>Limnaea natalensis</i>	0 out of 30	
July.....	(Pietermaritzburg)...	<i>Limnaea natalensis</i>	0 out of 6	
April.....	(Pietermaritzburg)...	<i>Physopsis africana</i>	12 out of 197	4
May.....	(Pietermaritzburg)...	<i>Physopsis africana</i>	4 out of 200	
July.....	(Pietermaritzburg)...	<i>Physopsis africana</i>	0 out of 6	
May.....	Toll Gate.....	<i>Limnaea natalensis</i>	7 out of 47	13.75
June.....	(Durban).....	<i>Limnaea natalensis</i>	1 out of 12	
July.....	(Durban).....	<i>Limnaea natalensis</i>	3 out of 21	
April.....	(Durban).....	<i>Physopsis africana</i>	1 out of 7	5
May.....	(Durban).....	<i>Physopsis africana</i>	7 out of 85	
June.....	(Durban).....	<i>Physopsis africana</i>	0 out of 13	
July.....	(Durban).....	<i>Physopsis africana</i>	4 out of 131	
April.....	(Durban).....	<i>Planorbis pfeifferi</i>	7 out of 24	30
May.....	(Durban).....	<i>Planorbis pfeifferi</i>	49 out of 163	
June.....	(Durban).....	<i>Planorbis pfeifferi</i>	7 out of 20	
July.....	(Durban).....	<i>Planorbis pfeifferi</i>	3 out of 13	
June.....	(Durban).....	<i>Isadora tropica</i>	0 out of 56	0
May.....	Umgeni (Durban)...	<i>Planorbis pfeifferi</i>	5 out of 15	13.33
June.....	Boshoff St.....	<i>Physopsis africana</i>	0 out of 20	0
July.....	(Pietermaritzburg)...	<i>Physopsis africana</i>	0 out of 6	
June.....	(Pietermaritzburg)...	<i>Ancylus</i>	0 out of 20	0
March.....	(Pietermaritzburg)...	<i>Isidora forskali</i>	0 out of 2	0
April.....	(Pietermaritzburg)...	<i>Isidora forskali</i>	0 out of 1	

PHYSOPSIS HARBORING BILHARZIA CERCARIAE, 1916

Month	Source	Number	Percentage
April.....	Toll Gate.....	1 out of 7	10
May.....	(Durban).....	13 out of 85	
June.....	(Durban).....	2 out of 13	
July.....	(Durban).....	8 out of 131	
April.....	Umsindusi.....	30 out of 197	18.6
May.....	(Pietermaritzburg)...	38 out of 170	
June.....	(Pietermaritzburg)...	7 out of 30	
July.....	(Pietermaritzburg)...	0 out of 6	
June.....	Boshoff St. Pool.....	0 out of 20	0
July.....	(Pietermaritzburg)...	0 out of 6	

With the exception of the Schistosome cercariae, we are at present entirely ignorant of the life-history of the various South African cercariae. Some of the "tadpole" forms may give rise to the flukes which occur in sheep and cattle in certain parts of the Transvaal, Natal, and Griqualand East. Others may produce the flukes which I am told are common in the lungs of frogs from some of the pools and rivers of Natal; but, as stated in a letter from Sir Arnold Theiler of the Agricultural Department, "Nobody has yet undertaken to work out the life-history of these flukes in South Africa, and the only reference is that given by Doctor Gilchrist in his book on South African Zoology."

The importance of this study is emphasized by our need of a drug to destroy the adult forms of cercariae in the human host. Perhaps a drug which would destroy the liver-fluke in sheep would be equally efficacious in destroying the Schistosome parasite of man.